INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan bersturktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1
C3

a) The following table shows the distribution of loads which are supported by cable produced by a company.

Jadual berikut menunjukkan agihan bebanan yang disokong oleh kabel dikeluarkan oleh sebuah syarikat.

Table 1a: The distribution of loads

Jadual 1a: Agihan bebanan

Load (kilo Newtons) *Bebanan*	Frequency *Frekuensi*
80 - 84	3
85 - 89	12
90 - 94	14
95 - 99	9
100 - 104	7
105 - 109	5

Calculate:
Kirakan:

i. Mean
Min

[3 marks]
[*3 markah*]

ii. Mode
Mod

[3 marks]
[*3 markah*]

iii. Variance and standard deviation
Varians dan sisihan piawai

[9 marks]
[*9 markah*]

CLO1
C3

b) A box contains 4 white balls and 3 red balls. One ball is drawn randomly from the box without replacement.
Di dalam sebuah kotak terdapat 4 biji bola bewarna putih dan 3 biji bola bewarna merah. Bola itu diambil secara rawak tanpa dimasukkan semula ke dalam kotak tersebut.

i. Draw the tree diagram
Lukiskan gambarajah pokok

[2 marks]
[*2 markah*]

ii. Based on the tree diagram at b(i), find the probability that:
Berdasarkan gambarajah pokok pada b(i), tentukan kebarangkalian bagi:

a. The first ball drawn is white and second ball is red
Bola pertama yang diambil adalah putih dan bola kedua adalah merah

[2 marks]
[*2 markah*]

b. Both balls are red
Kedua-dua bola bewarna merah

[2 marks]
[*2 markah*]

c. Both balls are same colour
Kedua-dua bola tersebut adalah sama warna

[4 marks]
[*4 markah*]

QUESTION 2

SOALAN 2

CLO1 C3

a) Solve the linear equations by using Crout Method.

Selesaikan persamaan berikut menggunakan Kaedah Crout.

$$5p - 3q + 2r = 1$$
$$2q + 3r = 2$$
$$-2p + 4r = 3$$

[15 marks]

[*15 markah*]

CLO1 C3

b) By using the Fixed-Point Iteration method, solve equation $x^3 + 3x^2 - 1 = 0$. Give the answer correct to (3) three decimal places. Given $x_0 = 1$.

Dengan menggunakan kaedah Lelaran Titik Tetap, selesaikan persamaan $x^3 + 3x^2 - 1 = 0$. *Berikan jawapan tepat kepada (3) tiga titik perpuluhan. Diberi* $x_0 = 1$.

[10 marks]

[*10 markah*]

QUESTION 3

SOALAN 3

CLO1
C3

a) Solve the following differential equations:

Selesaikan persamaan pembezaan berikut:

i. $\frac{dy}{dx} = \frac{5x^2}{3y^2 + 7}$

[5 marks]

[*5 markah*]

ii. $\frac{dy}{dx} + 5y = e^{5x}$

[5 marks]

[*5 markah*]

CLO1
C3

b) Solve the following second order of differential equations:

Selesaikan persamaan pembezaan peringkat kedua berikut:

i. $\frac{d^2y}{dx^2} + 10\frac{dy}{dx} + 25y = 0$

[4 marks]

[*4 markah*]

ii. $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 12y = 0$

[5 marks]

[*5 markah*]

iii. $\frac{d^2y}{dx^2} + 8\frac{dy}{dx} + 41y = 0$

[6 marks]

[*6 markah*]

QUESTION 4

SOALAN 4

CLO1
C3

(a) Mak Kiah has a part-time job where she takes order for banana cake and chocolate cookies. She sells cakes for RM 30 and RM 20 for each jar of cookies. It takes 1.5 hours to prepare one cake and 0.75 hours to bake a jar of cookies. Since this is Mak Kiah's part-time job, she could not spend more than 15 hours a week completing the orders. In addition, she can only bake no more than 10 cakes and 8 jars of cookies per week. Mak Kiah earned a profit of RM15 on each cake and RM11 on each jar of cookies. How many jars of cookies and cakes does she has to bake each week to maximize her profits?

Mak Kiah mempunyai pekerjaan sambilan di mana dia mengambil pesanan untuk kek pisang dan biskut coklat. Dia menjual kek dengan harga RM 30 dan RM 20 untuk setiap balang biskut. Ia memerlukan 1.5 jam untuk menyediakan satu kek dan 0.75 jam untuk membakar sebalang biskut. Oleh kerana ini adalah pekerjaan sambilan Mak Kiah, dia tidak dapat menghabiskan lebih dari 15 jam seminggu untuk menyelesaikan pesanan itu. Selain itu, dia hanya dapat membakar tidak lebih dari 10 kek dan 8 balang biskut seminggu. Mak Kiah memperoleh keuntungan sebanyak RM15 pada setiap kek dan RM11 pada setiap balang biskut. Berapa botol balang biskut dan kek yang dia bakar setiap minggu untuk memaksimumkan keuntungannya?

i. State the decision variables for the problem.
Nyatakan pembolehubah keputusan bagi masalah berkenaan.

[2 marks]
[*2 markah*]

ii. Write three inequalities that satisfies the constraints in the problem.
Tuliskan tiga ketaksamaan yang memenuhi kekangan dalam masalah berkenaan.

[3 marks]
[*3 markah*]

CLO1
C3

(b) Find the minimum value for the given Linear Programming Problem by using graph method.

Dapatkan nilai minimum bagi Masalah Pengaturacaraan Linear yang diberikan dengan menggunakan kaedah graf.

Minimize, $z = 40x + 36y$ subject to constraints:

Meminimumkan, $z = 40x + 36y$ *tertakluk kepada kekangan:*

$$10x + 6y \geq 75$$
$$x \leq 8$$
$$y \leq 10$$
$$x,\ y \geq 0$$

[10 marks]

[*10 markah*]

CLO1
C3

(c) Solve the linear programming problem using Simplex Method.

Selesaikan masalah pengaturacaraan berikut dengan menggunakan kaedah Simpleks.

Maximize, $z = x_1 + 3x_2$ subject to constraints:

Memaksimumkan, $z = x_1 + 3x_2$ *tertakluk kepada kekangan:*

$$x_1 + x_2 \leq 6$$
$$-x_1 + 2x_2 \leq 8$$
$$x_1,\ x_2 \geq 0$$

[10 marks]

[*10 markah*]

SOALAN TAMAT

FORMULA DBM30033 - ENGINEERING MATHEMATICS 3

DESCRIPTIVE STATISTICS		
Number of class	*Sturges Rule,* $k = 1 + 3.33 \log n$	*Rule of Thumb,* $2^k > n$
Mean	$\bar{x} = \frac{\sum x}{n}$	$\bar{x} = \frac{\sum (fx)}{\sum f}$
Median	$Median = L_m + \left(\frac{\frac{N}{2} - F}{f_m}\right) C$	
Mode	$Mode = L_{M_o} + \left(\frac{d_1}{d_1 + d_2}\right) C$	
Quartile	$Q_k = L_{Q_k} + \left(\frac{\frac{kN}{4} - F}{f_{Q_k}}\right) C; \quad k = 1, 2, 3$	
Decile	$D_k = L_{D_k} + \left(\frac{\frac{kN}{10} - F}{f_{D_k}}\right) C; \quad k = 1, 2, 3 \ldots 9$	
Percentile	$P_k = L_{P_k} + \left(\frac{\frac{kN}{100} - F}{f_{P_k}}\right) C; \quad k = 1, 2, 3 \ldots 99$	
Mean Deviation	$E = \frac{\sum \lvert x - \bar{x} \rvert}{n}$	$E = \frac{\sum (\lvert x - \bar{x} \rvert f)}{\sum f}$
Variance	$s^2 = \frac{\sum (x - \bar{x})^2}{n}$	$s^2 = \frac{\sum_{i=1}^{n} x_i^2 - n\bar{x}^2}{n}$
	$s^2 = \frac{\sum [(x - \bar{x})^2 f]}{\sum f}$	$s^2 = \frac{\sum fx^2}{\sum f} - \left[\frac{\sum fx}{\sum f}\right]^2$
Standard Deviation	$s = \sqrt{variance}$	

NUMERICAL METHOD	
Crout Method	$A=\begin{pmatrix} l_{11} & 0 & 0 \\ l_{21} & l_{22} & 0 \\ l_{31} & l_{32} & l_{33} \end{pmatrix}\begin{pmatrix} 1 & u_{12} & u_{13} \\ 0 & 1 & u_{23} \\ 0 & 0 & 1 \end{pmatrix}$
Doolittle Method	$A=\begin{pmatrix} 1 & 0 & 0 \\ l_{21} & 1 & 0 \\ l_{31} & l_{32} & 1 \end{pmatrix}\begin{pmatrix} u_{11} & u_{12} & u_{13} \\ 0 & u_{22} & u_{23} \\ 0 & 0 & u_{33} \end{pmatrix}$
Newton Raphson Method	$x_{n+1}=x_n-\dfrac{f(x_n)}{f'(x_n)}$
False Position Method	$x_0=\dfrac{1}{y_2-y_1}\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}$

PROBABILITY	
$E=pn$	$P(A\cup B)=P(A)+P(B)-P(A\cap B)$
$P(B\|A)=\dfrac{P(B\cap A)}{P(A)}$	$P(A\cap B)=P(A)\bullet P(B)$
	$P(A\cup B)=P(A)+P(B)$
	$P(A\cap B)=P(A)\bullet P(B\|A)$

SOLUTION FOR 1st ORDER DIFFERENTIAL EQUATION	
Logarithmic $a=e^{\ln a}$ $a^x=e^{x\ln a}$ $\int a^x\,dx=\dfrac{a^x}{\ln a}+c$	**Homogeneous Equation** $y=vx$ and $\dfrac{dy}{dx}=v+x\dfrac{dv}{dx}$ **Linear Factors (Integrating Factors)** $\dfrac{dy}{dx}+Py=Q$ $y\bullet IF=\int Q\bullet IF\,dx$ Where $IF=e^{\int P\,dx}$
GENERAL SOLUTION FOR 2nd ORDER DIFFERENTIAL EQUATION	
Equation of the form	$a\dfrac{d^2y}{dx^2}+b\dfrac{dy}{dx}+cy=0$
Quadratics Formula	$x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$
1. Real & different roots	$y=Ae^{m_1x}+Be^{m_2x}$
2. Real & equal roots	$y=e^{mx}(A+Bx)$
3. Complex roots	$y=e^{\alpha x}(A\cos\beta x+B\sin\beta x)$

DIFFERENTIATION			
1.	$\frac{d}{dx}(k) = 0\,,\quad k \text{ is constant}$	2.	$\frac{d}{dx}(ax^n) = anx^{n-1}$ [Power Rule]
3.	$\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$	4.	$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$ [Product Rule]
5.	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$ [Quotient Rule]	6.	$\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du}$ [Chain Rule]
7.	$\frac{d}{dx}(e^x) = e^x$	8.	$\frac{d}{dx}\left(e^{ax+b}\right) = e^{ax+b} \times \frac{d}{dx}(ax+b)$
9.	$\frac{d}{dx}(\ln\|x\|) = \frac{1}{x}$	10.	$\frac{d}{dx}[\ln\|ax+b\|] = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$
11.	$\frac{d}{dx}(\sin x) = \cos x$	12.	$\frac{d}{dx}(\cos x) = -\sin x$
13.	$\frac{d}{dx}(\tan x) = \sec^2 x$	14.	$\frac{d}{dx}[\sin(ax+b)] = \cos(ax+b) \times \frac{d}{dx}(ax+b)$
15.	$\frac{d}{dx}[\cos(ax+b)] = -\sin(ax+b) \times \frac{d}{dx}(ax+b)$	16.	$\frac{d}{dx}[\tan(ax+b)] = sec^2(ax+b) \times \frac{d}{dx}(ax+b)$
17.	$\frac{d}{dx}[\sin^n u] = n\sin^{n-1} u \times \cos u \times \frac{du}{dx}$	18.	$\frac{d}{dx}[cos^n u] = n\,cos^{n-1} u \times -\sin u \times \frac{du}{dx}$
19.	$\frac{d}{dx}[tan^n u] = n\,tan^{n-1} u \times sec^2 u \times \frac{du}{dx}$		

INTEGRATION			
1.	$\int ax^n dx = \frac{ax^{n+1}}{n+1} + c \quad ;\{n \neq -1\}$	2.	$\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{(a)(n+1)} + c \;;\{n \neq -1\}$
3.	$\int k\ dx = kx + c,\quad k \text{ is constant}$	4.	$\int_a^b f(x)dx = F(b) - F(a)$
5.	$\int \frac{1}{x}\ dx = \ln\ \|x\| + c$	6.	$\int \frac{1}{ax+b}\ dx = \frac{1}{a} \times \ln\ \|ax+b\| + c$
7.	$\int e^x\ dx = e^x + c$	8.	$\int e^{ax+b}\ dx = \frac{1}{a} \times e^{ax+b} + c$
9.	$\int \sin x\ dx = -\cos x + c$	10.	$\int \cos x\ dx = \sin x + c$
11.	$\int sec^2 x\ dx = \tan x + c$		
12.	$\int \sin(ax+b)\ dx = -\frac{1}{a} \times \cos(ax+b) + c$		
13.	$\int \cos(ax+b)\ dx = \frac{1}{a} \times sin\ (ax+b) + c$		
14.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		